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BEFORE THE
SUBCOMMITTEE ON TELECOMMUNICATIONS AND THE INTERNET,
COMMITTEE ON ENERGY AND COMMERCE,
UNITED STATES HOUSE OF REPRESENTATIVES
ON PROTECTING HOMELAND SECURITY: A STATUS REPORT ON
INTEROPERABILITY BETWEEN PUBLIC SAFETY COMMUNICATIONS
SYSTEMS
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Introduction

Good afternoon, Mr. Chairman and members of the Subcommittee. My name is Robert LeGrande. I am a Deputy Chief Technology Officer in the Office the Chief Technology Officer (OCTO), the central information technology and telecommunications agency of the District of Columbia government. I am responsible for wireless communications infrastructure for the District government, and a representative of the Spectrum Coalition for Public Safety. I will describe for you how the District now has a state-of-the-art public safety voice network, complete with local, regional, and federal, interoperability and where we came from to get to this state. I will also describe the Spectrum Coalition for Public Safety's efforts to secure additional 700 MHz spectrum which will enable Public Safety to build and deploy Broadband Wireless Networks throughout the U.S. To reach this level of interoperability, we had to take several steps. First, we had to upgrade the coverage and capacity of our pre-existing non-interoperable local networks. Next, we had to unify these separate networks. Finally, we had to create interoperability between our intra-District public safety communications systems and other first responders in the region. We reached these goals by completing two major projects in September 2003 and March of this year. We have now embarked on the next step in fully loaded public safety communications capabilities: creating the high-speed broadband wireless data communications urgently needed by first responders throughout the nation. (Please see Attachment I, *Public Safety Wireless Voice and Data Communications*, for a graphic representation of these initiatives.) I will describe each of these efforts in grater detail, focusing particularly on the interoperability challenges we faced and the solutions we developed.

Public Safety Voice Communications in the District of Columbia pre-September 2003

Before September 2003, the District's public safety radio communications infrastructure included two networks: a four-site Motorola SmartZone™ system operating at 800 MHz for Fire and Emergency Management Services (FEMS) and Emergency Management Agency (EMA) personnel, and a seven-site conventional analog system operating at 460 MHz for the Metropolitan Police Department (MPD). Both networks had major deficiencies. The FEMS network had insufficient in-building radio coverage in the core areas of the city -- limitations compounded by the complex architecture of buildings in

Washington, DC. (Despite these in-building coverage limitations, however, the network compared favorably with other major city networks in on-street coverage and quality.) There was no coverage in underground subway tunnels. The police network provided reasonable coverage throughout the city, but it was antiquated, failing, and in critical need of replacement. The network was over 30 years old, spare parts were no longer available from the original manufacturers, and some of them were no longer in business. Both networks suffered from capacity limitations. The FEMS-EMA 800 MHz network provided 16-radio channels, while the MPD UHF network had only 13 conventional channels and regularly experienced channel congestion intervals during the busiest hours. Our infrastructure had little to no interoperability within the District, due to the technical and operational disparity between the two networks, including frequency band and radio technology.

Public Safety Radio Communications Upgrade

To solve these problems, a team of Motorola and District of Columbia engineers worked for six months to design an optimal unified communications network that would address the interlocking deficiencies of coverage, capacity, and interoperability in Washington, DC.

Coverage Analysis and Design

City management set an aggressive coverage goal of providing 100% communications within the District while minimizing the need for radio-to-radio communications (talk-around). We met this challenge in two projects, an above-ground project completed in September 2003, and an underground project completed in March 2004.

Our above-ground coverage analysis revealed that it was impractical to cover the interiors of all buildings using traditional radio sites. Instead, the analysis yielded a strategy to cover the majority (85%) of exterior and interior locations by expanding antenna sites from four to 10 and explore alternatives for covering the remaining areas. These alternatives were in – building distributed antenna systems and in-vehicle repeater systems. Our team quickly discovered that in-building systems were extremely expensive, created noise in the system that would degrade overall coverage, and could easily fail during fires or terrorist attacks. Vehicular repeater systems presented none of these problems, although they could not provide the same transparency as in-building systems, because they require first responders to change channels on their radios from the city-wide network to the vehicular repeater frequency. The city piloted a half-dozen vehicular repeater systems and found that single or multiple units could solve coverage problems in the densest of District buildings. Ultimately, the District implemented vehicular repeater systems in 63 fire suppression vehicles to ensure that a VRS would be available wherever needed to enhance in-building communications.

The subway tunnel system presented a more daunting challenge. The coverage gaps in tunnels were far too great to be addressed by VRS systems. However, sufficient resources existed underground to support a distributed antenna system. Therefore, the

District, in partnership with The Metropolitan Area Transit Authority (WMATA) chose an underground distributed antenna system at 800 MHz and permitted the MPD to share WMATA's 490 MHz radio network that provides underground coverage. Key advantages of this system were the scope of coverage and transparency. Nearly 100% of all public underground areas were covered by the underground project completion date in March 2004,-- there remains one lone corridor with fair voice quality will soon be upgraded to excellent voice quality.

Together, our above-ground and underground coverage solutions deliver nearly 100% coverage with only very limited need for radio-to-radio communication and provide District of Columbia first responders with citywide clear voice communication.

Interoperability and Capacity Analysis and Design

In addition to providing our first responders with the best possible radio coverage, we needed to deliver the best interoperability and capacity solution – the ability for District first responders to communicate within their agencies and among the maximum number of external agencies whenever necessary. Most of the District's surrounding counties use Motorola SmartZone™ technology1[1] at 800 MHz. As discussed above, before the upgrade, the District had a seven site conventional analog system operating at 460 MHz for MPD and a four site Motorola SmartZone™ system operating at 800 MHz for FEMS and other District agencies. The District owned over 1,000 800 MHz radios compatible with the Motorola SmartZone™ system, nearly 2,000 portable 460 MHz radios with SmartZone™ capabilities and over 1,000 mobile 460 MHz radios capable of communicating on a SmartZone network. These same radios could be upgraded to support the public safety Project 25 radio standard, but not while maintaining important features and allowing dual-mode operations with SmartZone™ systems. Further, the surrounding municipalities operated mobile and portable radios that were programmed and configured to support SmartZone™ networks, but not Project 25 networks.

It is important to note that these radios operate in a single band. The 460 MHz radios operate in the 450 – 512 MHz range and the 800 MHz radios operate in the 806-824 MHz range. Therefore, a 460 MHz radio can not communicate directly on our neighboring county networks operating in the 806-824 MHz range. To alleviate this problem, the District aggressively sought to migrate MPD to 800 MHz. The team calculated a net requirement of 27-35 trunked voice channels at 800 MHz to satisfy aggregate demand for all District of Columbia public safety personnel. The District had 16 channels at 800 MHz and 13 channels at 460 MHz at the start of the analysis.

We considered several options for the migration:

- Implement additional 800 MHz frequencies,

- Use the public safety 700 MHz spectrum (24 MHz) and operate a 700/800 MHz network,
- Split the 16 existing 25 kHz channels to create up to 32 channels, and
- Create a dual-band 460/800 MHz network.

I'll review each option briefly.

Implement Additional 800 MHz Frequencies

To satisfy the aggregate demand, the District would need an additional 12 frequencies in the 800 Mhz band. Unfortunately, given the presence of our neighboring jurisdictions and Nextel in this band, we could not identify enough 800 MHz channels to meet our needs. We approached Nextel and engaged vendors to investigate short-spacing channels, both without success. Therefore, we had to discard this option.

Use the Public Safety 700 MHz spectrum (24 MHz) and Operate a 700/800 MHz Network

The additional channels in the 24 MHz of radio spectrum in the 700 MHz band presented some compelling opportunities. First, there were cost-effective multi-band radios on the market that could operate in both 700 and 800 MHz2[2]. Second, there was considerable capacity in that band. Third, the technology used in the 700 MHz band, Project 25, was in the process of standardization, and therefore, presented an opportunity for expanded vendors and products. However, given the majority of users and systems operating SmartZone systems, our network needed to provide SmartZone service to agencies supporting District first responders within the city. Unfortunately, no integrated, dual-mode (P25 and SmartZone) network existed.

Moreover, the availability of the 700 MHz band was limited by the presence of TV broadcasters in our region. Therefore, we had to conclude that this option not feasible and halted efforts to build a Project 25-compatible network.

Split Existing 800 MHz Channels to Create up to 32 Total Channels

To implement this solution, a vendor would have to enable the use of adjacent channels at 12.5 kHz (instead of the existing 25 kHz) without interfering among the channels. Given the preponderance of SmartZone™ systems in the region, we first explored creating a SmartZone system that could utilize the half-spaced channels. Unfortunately, this option proved infeasible because the SmartZone system could not tune to those interspaced frequencies.

Create a Dual-Band 460/800 MHz Network

The dual band option would provide city-wide service from all sites at both bands and integrate them at a central hub. Analysis revealed that this option was not only feasible, but highly advantageous. It relied on existing frequencies licensed to the District of Columbia, and therefore presented limited risk of interference and licensing issues with the Federal Communications Commission (FCC). Motorola's existing SmartZone architecture could create a zone at 460 MHz and 800 MHz. This solution could incorporate all of the existing 800 MHz radios and over half of the MPD radios. It also allowed adjacent agencies using 800 MHz radios to communicate with MPD radios at 460 MHz through the central hub. Further, by incorporating trunked radio technology, this solution delivered the maximum number of individual communications paths for simultaneous incidents. For example, this solution allows our first responders to communicate with Prince George's County Police while simultaneously maintaining a separate communications channel with United States Park Police but not consume resources when those channels were not needed. In addition, because WMATA uses a Motorola SmartZone network operating at 490 MHz, MPD could gain direct interoperability with WMATA and MPD will gain coverage within the tunnel system in July 2004. The dual-band option could also support a total of 27 trunked voice channels, providing adequate capacity for the first time.

The main disadvantage of this option was lack of interoperability for MPD officers operating outside the coverage area of our District of Columbia 460 MHz network. However, the disadvantage proves relatively insignificant. MPD officers travel outside our coverage area infrequently, as most mutual support situations (e.g., July 4th, Presidential Inaugurations, marches, and demonstrations) bring officers from neighboring municipalities into the District.

Upgrade Implementation

We implemented the coverage, interoperability, and capacity solutions I've just described on a fast track (April 2002-March 2004, less than two years from conception to completion) and at a relatively reasonable total cost of $42 million ($36 million in federal emergency preparedness funds, $2.5 million in grants, and $3.45 million in District funds). The results, as I've indicated, were overwhelmingly successful: we now have a full-coverage, 27 trunked voice channels, regionally interoperable system providing clear voice communication, encryption, and other digital features for all our first responders.

Of course, we faced numerous challenges along the way. We overcame these challenges through clear, unified direction and support from our Mayor, City Council, Deputy Mayor for Public Safety, Chiefs of Police and FEMS, Chief Technology Officer, and police and fire unions. In addition, we were fortunate in having strong, knowledgeable, and driven corporate partners, Motorola, Inc. and Televate, LLC.

<u>Radio Interoperability within the National Capital Region/Council of Governments</u>

The National Capital Region (NCR) consists of in two states (Virginia and Maryland) and the District of Columbia. Voice radio interoperability for public safety entities in this region is essential. Equally essential for the District is interoperable communications with multiple critical federal agencies including the FBI, Secret Service, Bureau of Alcohol, Tobacco, and Firearms (ATF), Federal Emergency Management Agency (FEMA), the State Department, and others. There are also over 40 federal law enforcement agencies operating in the city, including Capital Police, Park Police, Mint Police and many others, with whom MPD dispatch and police officers must have direct communications. Finally, it is important that the District maintain communications within the WMATA subway tunnels and directly with police and airport authorities at the Reagan National Airport.

As illustrated in Attachment II (*Regional Public Safety Wireless Communications Interoperability*), establishing voice radio interoperability with this wide array of agencies, many of which are operating multiple radio technologies in different regions of the radio spectrum, including VHF, UHF and 800 MHz, is a major technical, operational and administrative challenge. The interoperability cube in the attachment depicts the levels of interoperability planned by the region. The region continues to implement solutions to further enhance and simplify radio communications. More funding for technical and operational standards development and training, along with the installation of permanent, dedicated "interoperability" managers and technicians is required to ensure that these solutions remain readily available on demand in the community.

In order to simplify this complex radio communications effort, interoperability has been engineered into three levels.

Level One Interoperability: Spare incident radios (radio cache) operating on common interoperable channels, including mutual aid, are made available to local and national responders who do not have programmed UHF and 800 MHz trunked radios or conventional radios on regional mutual aid channels. The simplest, but not necessarily the most effective, means to achieve interoperability is to distribute on-location radios to incident commanders and responders. Existing radio caches and excess spare radio inventories within the District and NCR/COG are distributed as appropriate. In response to an identified shortage of spare radios in the NCR, the federal government provided a grant in FY 2004 to increase the availability of 800 MHz trunked radios. A 1,000 unit *COG Radio Cache* will be available beginning in mid-summer of 2004, just weeks away.

Level Two Interoperability: In order to achieve a higher level of interoperability within the NCR between separate public safety portable/mobile radios and telephone system exchanges, regional partners have implemented a "radio interface module" manufactured by JPS Communications, the ACU-1000. With assistance from the Department of Homeland Security (DHS) wireless division, SAFECOM, this technology has been successfully implemented in most of the jurisdictions and agencies (local, state and federal) in the region. The ACU-1000 device provides communication "patching" between agencies by integrating agency radios into an interface module. Radio patching allows dispatchers to manually facilitate radio communications between users of different technologies and frequencies. The District's ACU-1000 unit encompasses 21 distinct radios, supporting all local fire and police agencies and critical federal agencies.

Radio patching through the ACU-1000 or similar devices, while effective in enhancing interoperability, has various limitations and presents operational challenges. Agency radios must be integrated, maintained and programmed to reflect the latest radio user template. Since templates change almost annually for most public safety radio users, it is difficult to maintain up-to-date radios in the device. The technology also entails complicated set-up protocols, requires user training, and lacks standardized operational procedures. Because these devices are not daily equipment, end users can become "rusty" and function improperly. Because the networks are not integrated, this is the only means to connect multiple networks today.

Level Three Interoperability: The most effective route to interoperability for co-located work groups is to install directly compatible, same-technology systems and radios (trunked or conventional). Trunked networks, common in the NCR, must be programmed with common trunked system and radio IDs and interoperable talkgroups. Most of the fire department users in the region, except for Prince George's County in Maryland, have direct access to each other's 800 MHz trunked radio networks. When first responders in the region enter the city to assist the District's fire department, they can communicate on the District's radio network or vice versa. All users are operating on a common radio network using the same radio technology.

The new MPD radio network, while not at 800 MHz where surrounding county police reside, was designed to be fully compatible with local law enforcement radio networks through the use of a Motorola SmartZone radio network switch. The District is able to provide local law enforcement users access to the District 800 MHz trunked network, which supports direct communications with MPD radio users on their UHF network.

An alternative to direct radio network compatibility is to establish mutual aid channels for non-standard network users with call-in capability to a dispatch console. The District has implemented a conventional VHF channel that facilitates direct access for several federal agencies to the District's citywide MPD dispatcher. A federal user with this channel programmed into his/her radio can direct call the MPD dispatcher to request MPD support and/or communication with individual MPD officers. The District is now working with SAFECOM to enhance this mutual aid network, expand the number of usable channels to three, and extend coverage throughout the NCR. This approach will support regional interoperability between the District and federal user agencies and enhance interoperability among federal agencies and between federal users and surrounding NCR first responders. While not a perfect interoperability solution, the mutual-aid-channel design will provide near-term mobile communications between responder agencies.

Attachment III (*DC-Regional PS Voice Interoperability Status*) presents a tabular view of current and in progress interoperability within the NCR. This summary reflects the work of hundreds of public safety officials, first responders and technologists, who, with the support of Congress, dedicate their energy and lives to ensuring reliable and functional radio communications within the region and beyond. However, while our success to date is encouraging, we have more work to do to achieve simple, on demand regional and federal interoperability within the region. Public safety radios must be programmed directly to change talkgroups or frequencies. Therefore, while an interoperable network infrastructure exists, a considerable amount of work still remains to reprogram thousands of radios and train first responders how to use the new capabilities. Additionally, as discussed below, the Washington, DC NRC does not have interoperability with key Department of Defense agencies that is vital to higher-level emergency response.

Interoperability Between the District and Department of Defense Agencies

District officials and technologists have recently begun discussions with various Department of Defense (DoD) agencies to analyze the current state of interoperability between the parties. While the investigation is still in its infancy, hampered by lack of dedicated staff and capital resources, the results are clear: interoperability between NCR first responders and critical DoD agencies is insufficient and must be increased now to ensure that the affected agencies can meet near-term emergency communications requirements. The recommendations agreed upon between the DoD and NCR include implementing technical and operational solutions that are available today and expanding and institutionalizing the dialogue between the affected agencies to ensure that planned radio network changes and upgrades are regularly addressed and incorporated into the interoperability operations. It is important to note, however, that the District is already providing technical support to the Washington National Guard and has designed interoperability into a radio network enhancement that the Guard is now undertaking.

Wireless Broadband Data Needs

The Challenge of High-speed Wireless Data Communication

The District's current wireless data communications capabilities rely on commercial cellular offerings at low speed (19.2 kbps). This speed provides extremely limited capabilities, largely restricted to text transmission. It also places public safety at risk from commercial networks that are not built to withstand long periods without power (e.g., hurricanes and winter storms) and lack enough redundancy to maintain connectivity between transceiver sites and central hubs. Additionally, the commercial technology upon which the District's public safety communications relies will be dismantled in 2005 forcing the District, and all such users nationally, to migrate to an alternative wireless transport technology.

Adequate response to emergencies ranging from multiple-alarm building fires to chemical, biological and other terrorist attacks requires immediate and rapid communications among multiple first-responders including fire, police, and emergency medical services. Currently, first-responders must rely on voice communications to receive time-sensitive information about an emergency incident. Information often comes too late or is lost altogether. Broadband wireless networks can dramatically improve public safety communications and operations nationally by providing full-motion, high-resolution video and other bandwidth-intensive monitoring tools to multiple first responders. These tools will allow sharing of time-critical information needed to respond more effectively to both routine and catastrophic events.

The demand on a wireless broadband network from one user can range from low-speed web browsing at 50-200 kilobits per second (kbps) to multiple real-time streaming video images transmitted at 1.2 megabits per second (Mbps). The District has demonstrated that its aggregate citywide demand on a network can exceed 50 Mbps and that usage can be concentrated in one area to require 10 Mbps per transmission site. Unfortunately, current public safety spectrum allocations at 700 MHz and 4.9 GHz for wireless data do not meet these needs, as data speeds do not meet individual and aggregate demand levels, or service is limited geographically and first responders must travel to hotspots to secure information – potentially losing critical life-saving time. Attachment IV (*Public Safety Spectrum Overview 1 and 2*) provides an analysis of the options available to public safety to satisfy high-speed wireless data needs.

At the root of the problem are radio propagation and channel bandwidth. The former results in signal degradation as the first responder travels farther from the transmission site (or when walls or other obstructions lie between the two endpoints). The latter results in decreased channel rates.

The propagation characteristics of radio frequency waves at 4.9 GHz and radio frequency waves at 700 MHz are so different that they result in extremely high deployment costs and operational costs for 4.9 GHz systems. In particular, as the transmitted frequency rises, the RF wave propagation transmission losses increase, thus reducing the coverage area of a base station. Therefore, assuming the deployment of the same technology, complete coverage of a city like Washington, DC would require significantly more sites at 4.9 GHz rather than at 700 MHz.

For instance, if we assume free space propagation conditions, all things besides the frequency considered being equal, the range of a 4.9 GHz base station would be seven times smaller than the range of a 700 MHz station3[3]. Consequently, to provide citywide coverage would require almost 50 times the number of antenna sites at 4.9 GHz as at 700 MHz. The District of Columbia has estimated that about 420 sites would be needed to provide comprehensive coverage throughout the city at 4.9 GHz instead of the 10 required at 700 MHz, leading to significant deployment costs and prohibitive operational costs.

Actually, these comparisons are optimistic, as they are based on a free-space propagation assumption. In fact, the reality of the mobile propagation environment is worse, and actually worsens for higher frequencies. As described in a white paper published by TROPOS networks4[4] natural or man-made obstacles generate propagation losses in addition to the free space propagation loss. In the referenced paper the authors compare 2.4 GHz to 4.9 GHz propagation characteristics. However, for the reasons explained above (propagation performance worsens as the frequency increases), the numbers in this paper would have to be considered lower bounds of propagation differences between 700 MHz and 4.9 GHz.

Those significant additional signal losses at the higher frequencies suggest that 50 to 100 *times* more sites would be needed for wireless coverage at 4.9 GHz to match coverage at 700 MHz. Thus, the 4.9 GHz spectrum is fundamentally limited in reach and requires numerous repeaters to reach even marginal distances. It is actually best suited to line-of-sight propagation, e.g. rooftop-to-rooftop communications, mesh-type networks where users can create a daisy chain for end-to-end communications, or short-distance communications around a fixed location (hot-spots).

Most public safety wireless data applications are expected to reach or support first responders wherever they are located in the District, whether driving car in a park or working in buildings. The 700 MHz band is the best-suited spectrum to support those applications.

Channel Bandwidth and Numbers of Channels

The maximum channel bandwidth in the existing 700 MHz allocation to public safety is 150 kHz. Technologies such as the standardized TIA-902 Scalable Adaptive Modulation have been tailored to this channel bandwidth and offer speeds up to 460 kbps. Unfortunately, this bandwidth does not support multiple video streams for an individual user. Furthermore, the 12 MHz5[5] of radio spectrum set aside for wideband data must be shared among three states and over a dozen public safety agencies. Consequently, the District expects no more than three or four paired channels offering peak *citywide* throughput of 1.4 to 1.9 Mbps – far less than projected citywide demand and much less than aggregate demand for one transmission site.

Requirements for Broadband Wireless Data for First Responders

First responders need video, Geographical Information Systems (GIS), high-resolution still images, and other broadband data wherever their work takes them. On the highways, high-resolution images must be delivered as soon as possible. At the farthest points of any service area, first responders need to send and receive video for appropriate support. Further, first responders need broadband data delivered deep inside buildings on portable handheld devices, just as voice signals are now delivered by our new voice network. Table-1 below outlines the multiple requirements for broadband wireless data for first responders:

General Requirements	
User Throughput	Designed to 80% load
Downlink (kbps)	1,500
Uplink (kbps)	500

Scalability	High, Minimal coordination burden when increasing capacity.
Mobility	Vehicular (>80 mph)
Coverage	Wide area (95% of Outdoor Area)
Connectivity	All IP addressable.
Cost	Comparable with existing cellular solutions.
Terminals	Supports standard device interfaces and offers low power consumption and small form factor options.
Large-Scale Incident Throughput Requirements	
Aggregate Demand (Entire District)	
Downlink (kbps)	56,100
Uplink (kbps)	20,080
Throughput Concentration	70% of major incident traffic in 20% of the city geography
Per Site Throughput (demand)	10 sites with the above throughput concentration
Downlink (kbps)	7,860
Uplink (kbps)	2,951
Per Site Throughput (with margin)	Designed to ~ 80% load
Downlink (kbps)	10,000
Uplink (kbps)	3,700
Net Capacity (Entire District)	
Downlink (kbps)	100,000
Uplink (kbps)	37,000

Table **Error! Bookmark not defined.**: Summary of Technical Requirements

National Coalition for Public Safety Broadband Spectrum

Recognizing that our wireless high-speed broadband data needs were the same as those of the rest of the nation, the District of Columbia founded the Spectrum Coalition for Public Safety (see Attachment V, *Spectrum Coalition Fact Sheet*). Thirty States, counties, cities, regions and public safety organizations quickly joined the Coalition. The public safety communications organizations documented their support in the attached letter (Attachment VI, *Public Safety Organization Support for New Broadband Spectrum Allocation*). The Coalition's objectives are to pursue legislation that would require the FCC to reserve 10 MHz of radio spectrum for wide area public safety broadband wireless uses; to enable competitive, affordable technologies that meet first-response requirements; and to facilitate nationwide network deployment. We have developed draft legislation (Attachment VII, *First Responders Enhancement Act (FREA)*) that calls for the spectrum allocation changes and have briefed more than 35 House and Senate member offices on our goals.

Design and Installation of Pilot Network

The urgent needs of first responders in the District of Columbia required more than pursuing legislation to facilitate network deployment. Our need is real and immediate. With the support of our public safety, technology, legislative, and executive leaders and our corporate partners -- Motorola, Inc. and Flarion Technologies, Inc. -- we obtained an experimental license from the FCC and are now installing the nation's first high-speed broadband wide-area wireless network for public safety. One additional partner, SAIC, is assisting us with application analysis. We have one live transceiver site and can transmit broadband radio signals throughout the Capitol Hill area. In late summer of 2004 we will complete installation of all 10 transceiver sites in the network and will provide broadband radio coverage throughout the District of Columbia. We will use the pilot to refine our system requirements for usability, scalability, reliability, and security. The applications planned for testing on the network include remote chemical and biological agent detection, video surveillance; helicopter video support, bomb squad video support, GIS applications, and EMS remote doctor support. This pilot network, with the full 10 MHZ allocation, will meet the requirements outlined in Table 1.

Conclusion

As the nation's capital, the District of Columbia faces unique and unusual public safety communications challenges. We have met the first level of these challenges by upgrading our public safety voice network to one of the best in the nation. We look forward to complementing that network with the nation's first citywide wireless broadband public safety network, and we hope that our leadership of the Spectrum Coalition will enable other jurisdictions to have the same public safety tools in the near future. We appreciate the support that the Coalition has received in both the Senate and House of Representatives and look forward to continuing our dialogue with the nation's leaders on the Coalition's critical objectives.

6[1] For purposes of simplicity, we use SmartZone™ generically to describe both SmartNet™ and SmartZone™ systems.

7[2] However, the entire police department would need new 800/700 radios, and FEMS might need new radios as well (their radios supported only 800 MHz). The result would be between 5,000 and 7,000 new 800/700 MHz radios costing $7-13 million more than the cost of upgrades to 460 MHz radios and new digital-capable 460 MHz radios.

8[3] The free space propagation at 1 km is 89.3 dB at 700 MHz, and 106.2 dB at 4.9 GHz. Those 17 dB propagation difference would result in a coverage radius ratio of 7 (coverage area ratio of 49), between the two frequency bands. Therefore obtaining the same services provided by the 10 sites covering the city at 700 MHz today would require more than 400 sites at 4.9 GHz.

9[4] See http://www.troposnetworks.com/pdf/Spectrum_Whitepaper.pdf for further details.

10[5] This represents the paired amount of spectrum for frequency duplexed operation. Of this 12 MHz, 5.4 MHz is reserved for future applications by the FCC. The total number of 150 kHz paired channels is 40.